

Large-Area, Solid-State Photomultiplier for Ultraviolet Detection, Phase I

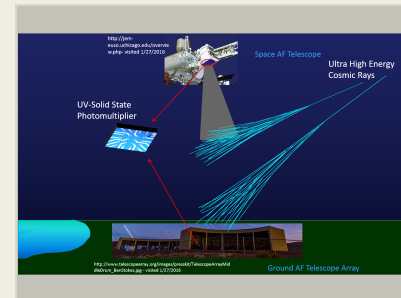
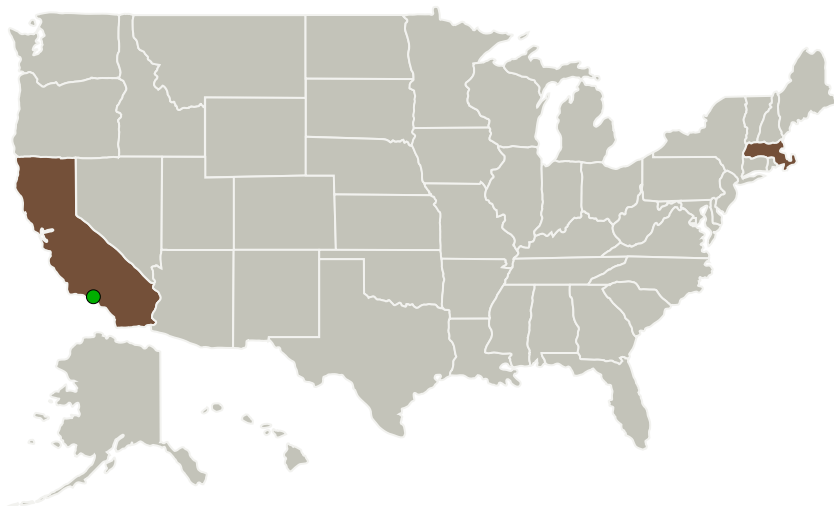
Completed Technology Project (2016 - 2016)



Project Introduction

To detect air fluorescence generated from cosmic rays with energies exceeding 1019 eV, which are rare events that produce small light flashes at the detector, a large-area, high sensitivity UV (300-400 nm), single-photon detector is needed. Radiation Monitoring Devices, Inc. (RMD), proposes to design and develop large-area solid-state photomultipliers (SSPMs) based on wide band-gap materials. As the intrinsic carrier concentration is directly related to the band gap of the material, the thermally generated dark current associated with WBG materials will be much lower than silicon for a sufficiently small defect density in the bulk material. The proposed WBG SSPMs will have high gain (105-106), low noise (100 times lower than similar size Si based device), fast response (<5ns), high detection efficiency (>50%) and sensitivity to a single photoelectron at wavelengths between 300 and 400 nm. In phase-I efforts we will explore different design options to improve detection efficiency, response time of the GPD structure. Based on improved GPD structures we will design and fabricate 3mm x 3mm WBG SSPMs. Finally, its basic performance will be evaluated and compared to SSPMs from other vendors and PMTs. The Phase-II effort will develop the large-area multi-element devices and the readout for imaging.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Completed Technology Project (2016 - 2016)



Organizations Performing Work	Role	Type	Location
Radiation Monitoring Devices, Inc.	Lead Organization	Industry	Watertown, Massachusetts
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

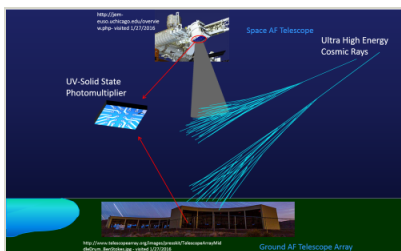
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139867>)

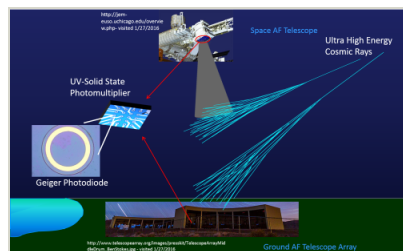
Images



Briefing Chart Image

Large-Area, Solid-State Photomultiplier for Ultraviolet Detection, Phase I

(<https://techport.nasa.gov/image/132304>)



Final Summary Chart Image

Large-Area, Solid-State Photomultiplier for Ultraviolet Detection, Phase I Project Image
(<https://techport.nasa.gov/image/125861>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Radiation Monitoring Devices, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

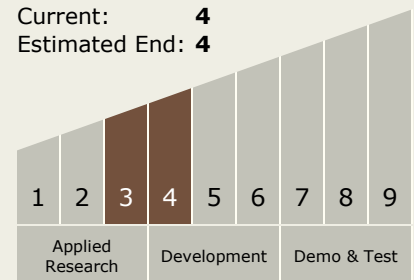
James Christian

Technology Maturity (TRL)

Start: **3**

Current: **4**

Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.3 In-Situ Instruments and Sensors
 - └ TX08.3.1 Field and Particle Detectors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System